TAMDAR

Tropospheric Airborne Meteorological Data Reporting

System Implementation

NASA WxAP Review

June 2, 2004

Topics

- Program Background
- NASA-AirDat Partnership
- TAMDAR Sensor and System
- Implementation of TAMDAR System
  - Deployment Plans
  - Datalink
  - AirDat Infrastructure
  - AirDat/TAMDAR Products and Services

TAMDAR Background

NASA-backed aviation safety initiative

- Real time reporting of hazardous conditions including icing & turbulence
- Improved aviation weather information
- Produce automatic, non-subjective, electronic pilot reports

Multi-function airborne atmospheric sensor

- Self-contained
- Minimize aircraft interfaces
- Minimize certification issues, time & cost

The TAMDAR sensor

Detects and determines:

- Ice presence
- Median and peak turbulence
- Static pressure and pressure altitude
- Air temperature (Mach corrected)
- Relative humidity
- Indicated and true airspeed
- Winds aloft
- Built-in GPS

NASA-AirDat partnership

- Relationship has been very productive
- NASA has actively supported AirDat's development of the TAMDAR sensor over the past four years
- This partnership has facilitated successful technology development and beta testing on numerous aircraft
- NASA and AirDat are currently implementing the first regional deployment of a fully-certified TAMDAR system

NASA-AirDat partnership

NASA

- Provided design guidance and input
- Arranged flight test bed aircraft
- Developed relationships with NOAA/FSL/NWS and FAA
- Identified and contacted potential carriers
- Provided substantial R&D support

NASA-AirDat partnership

AirDat

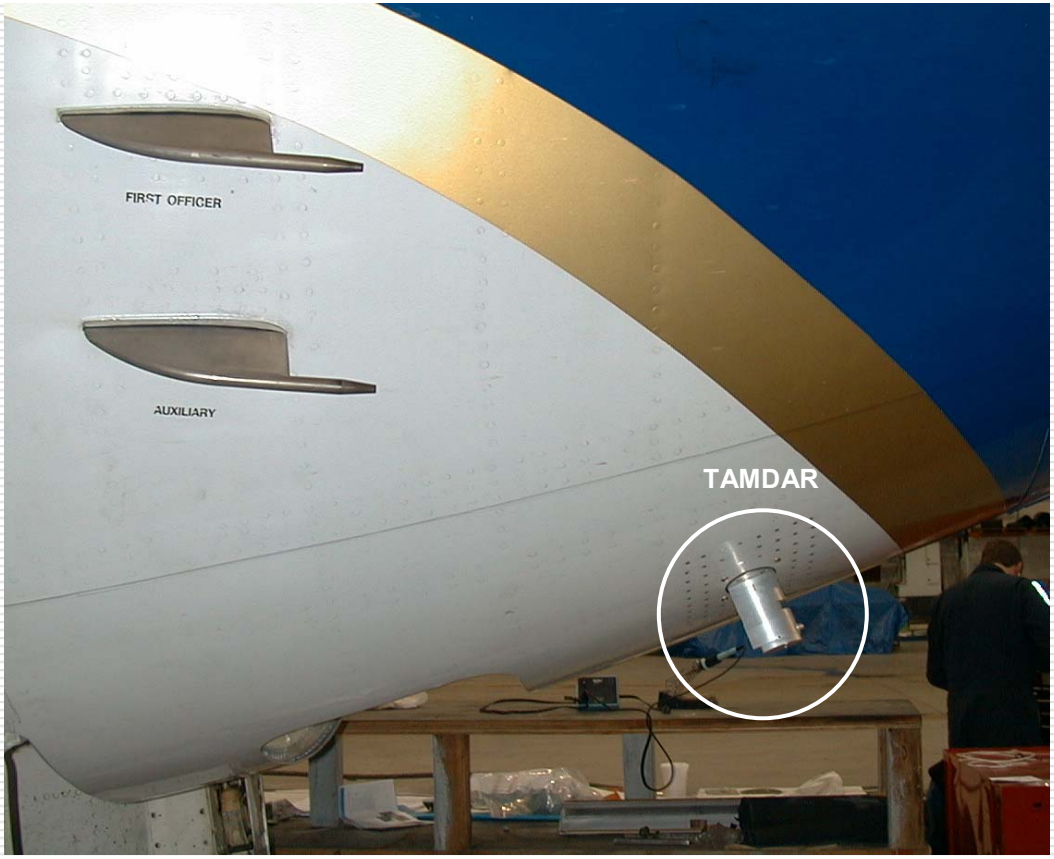
- Designed and developed sensor
- Conducted test flights
- Certified and is manufacturing sensor
- Implemented TAMDAR data center and infrastructure
- Planning TAMDAR system implementation nationwide
- Invested substantial private capital in the TAMDAR project

TAMDAR probe on Saab 340

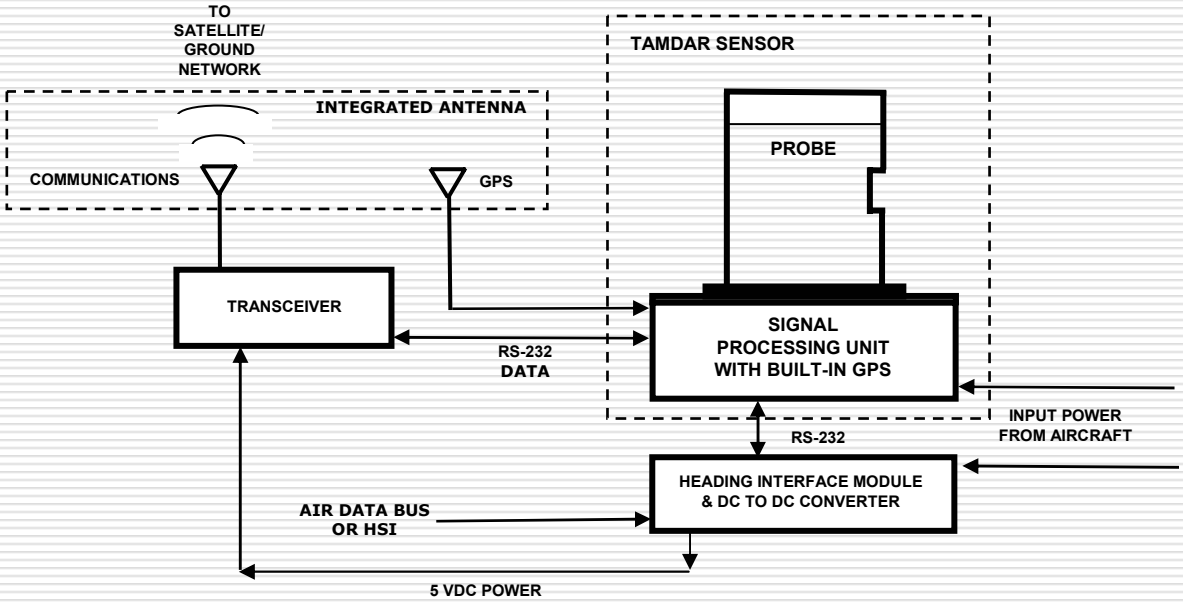
AIRDAT

TAMDAR probe on Saab 340

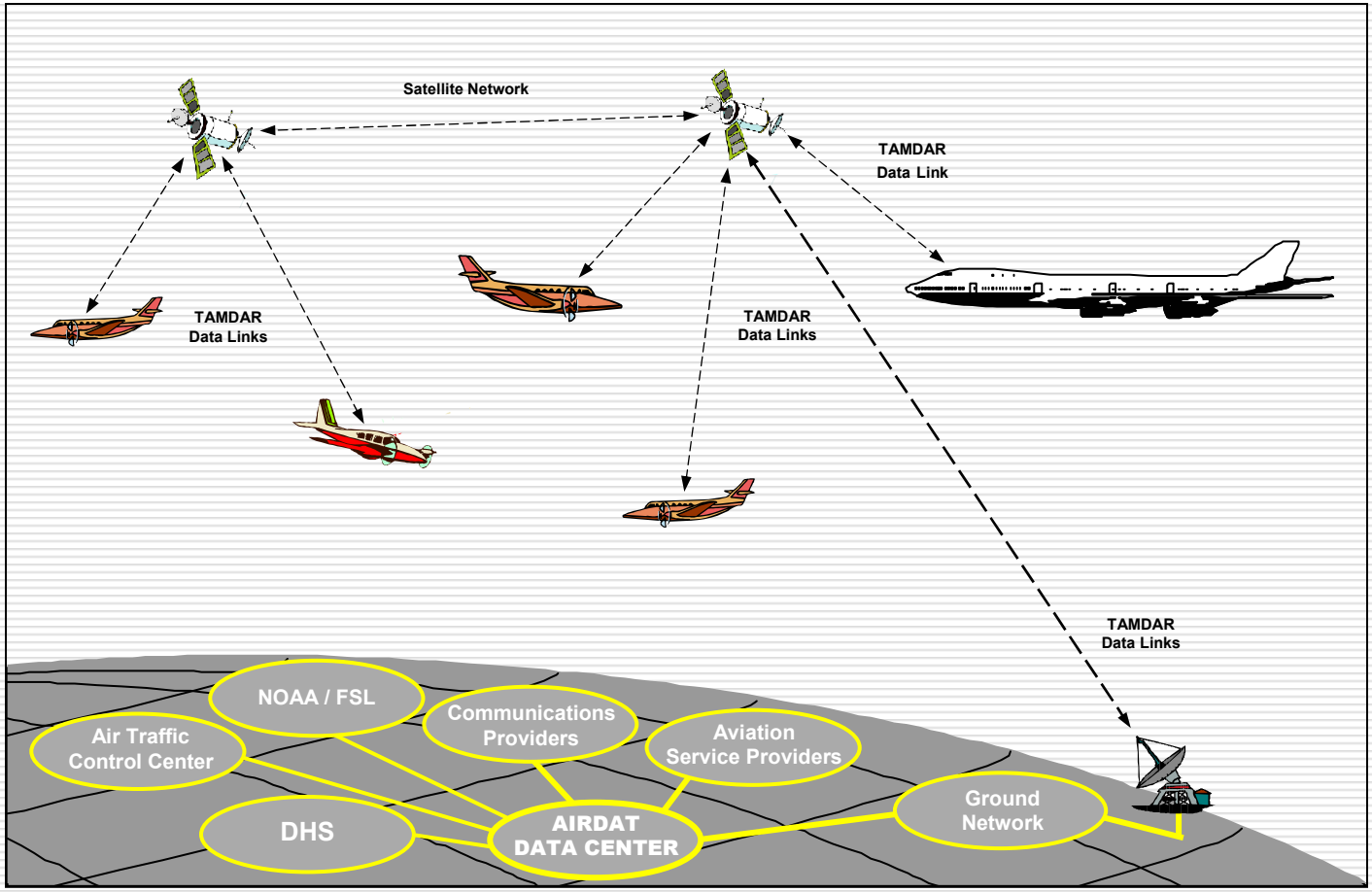
TAMDAR probe on Boeing 727



TAMDAR airborne unit



The TAMDAR System



Observations and reports

AIRDAT

- Pressure-based observations with time defaults (preferred by meteorologists)
- Automatically controlled and buffered by TAMDAR sensor—no CMS required
- Active control from AirDat data center
  - Adjustable by remote command
    - Intervals and defaults
    - Calibration constants
    - Concentration and distribution of observations
- Upgrades to firmware can be easily bootloaded

Deployment plan

AIRDAT

CONUS deployment

- Mesaba Saab 340 fleet in Great Lakes Region (64 aircraft—beginning June 2004)
- ~ 1500 aircraft—next two years

Carrier participation benefits

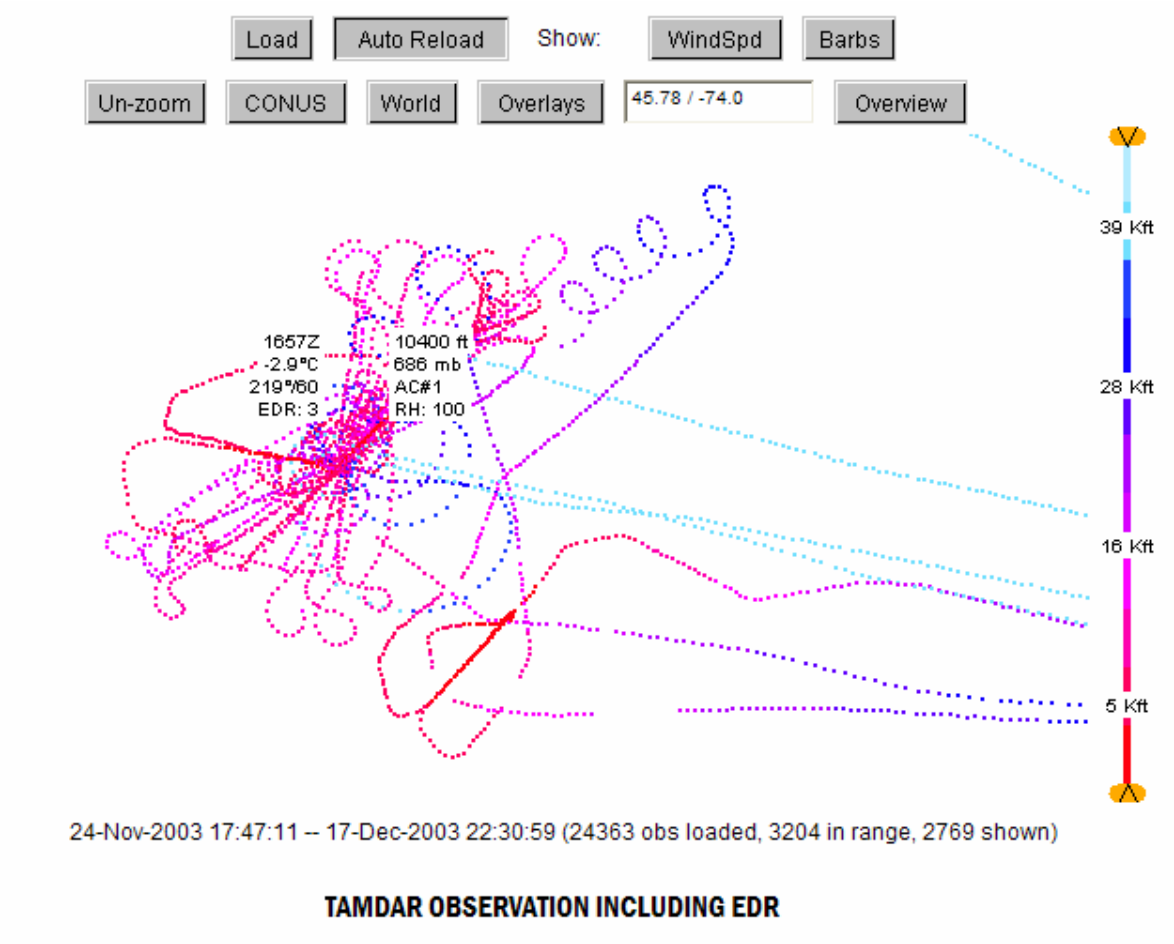
AIRDAT

Enhanced flight safety and operations

Weather information

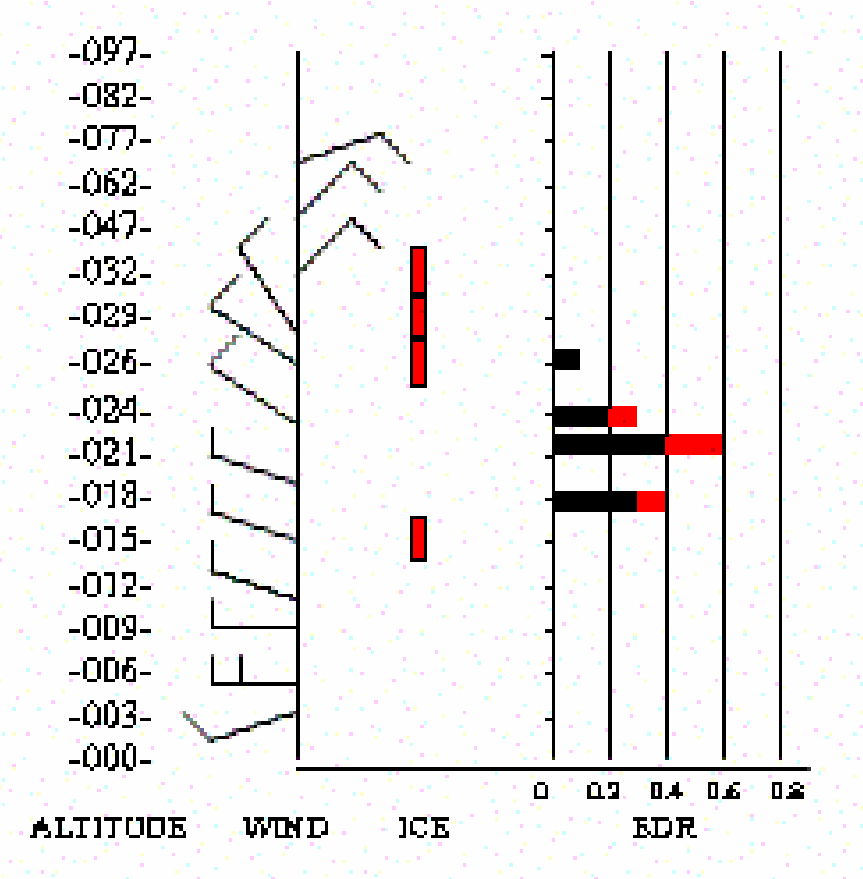
- Real time icing and turbulence reports
- Improved operational forecasts
- Real time weather information to the cockpit

Aviation weather products



Display Derived from FSL ACARS display developed by Bill Moninger

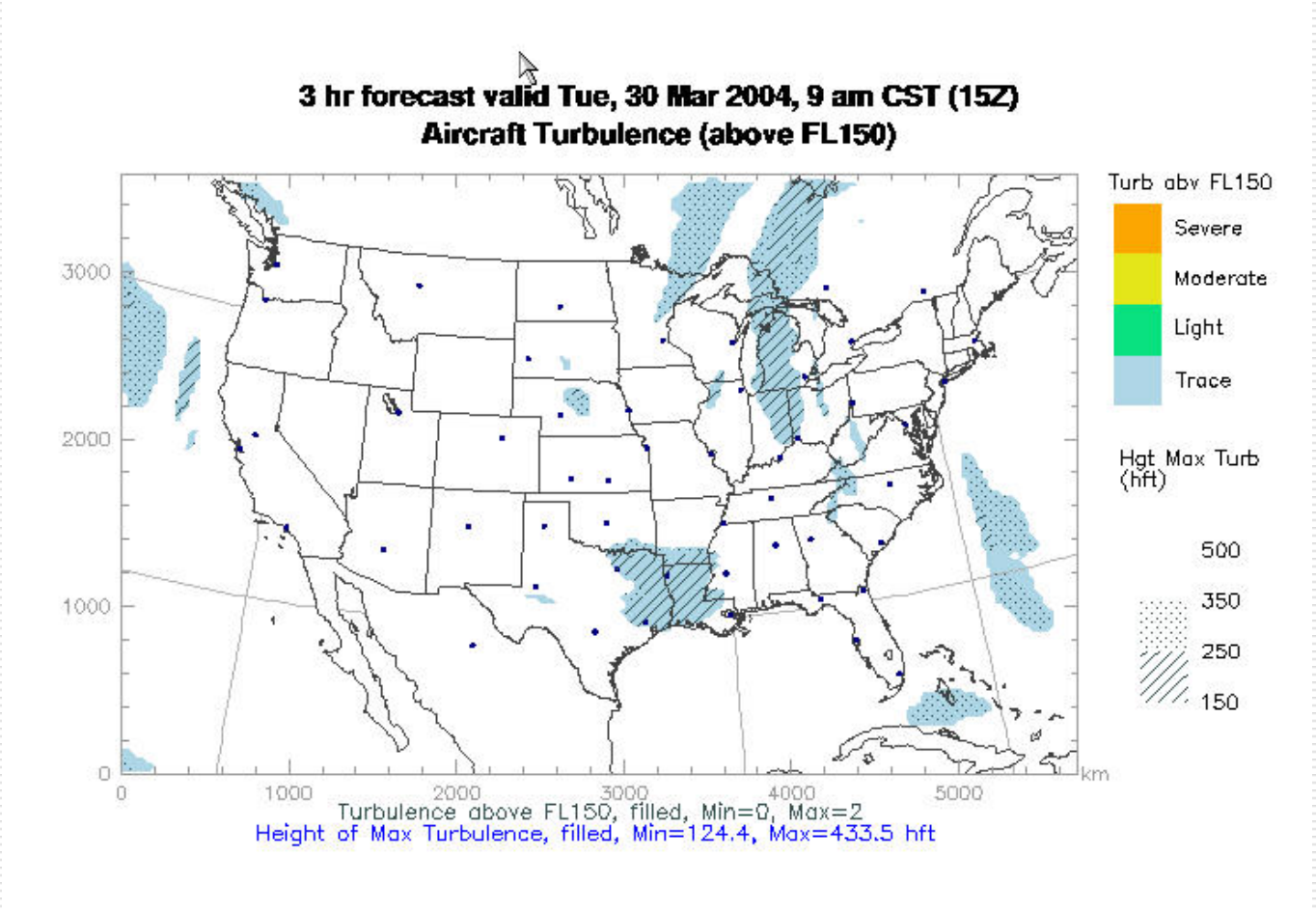
Aviation weather products



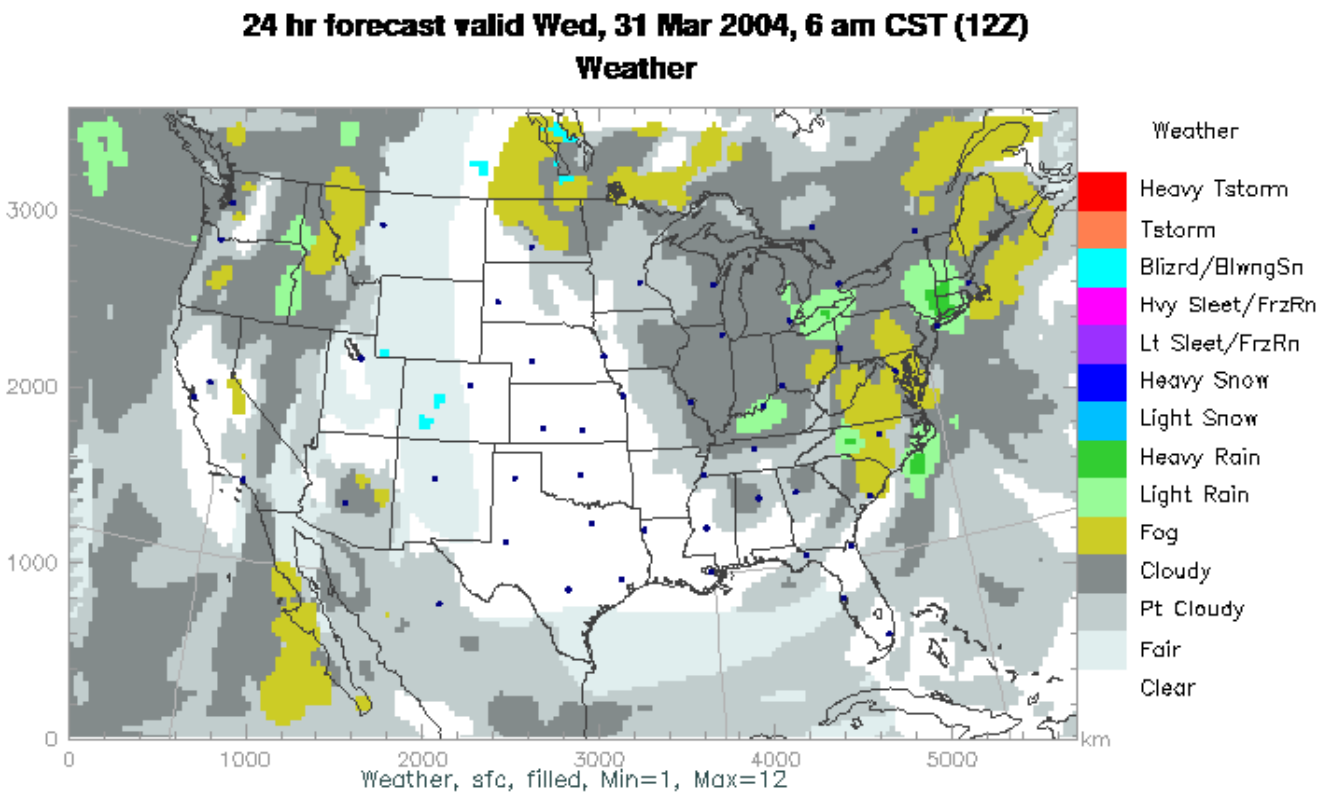
Various display types are possible

This is an example of a ground-based meteorological tool

Aviation weather products



Aviation weather products



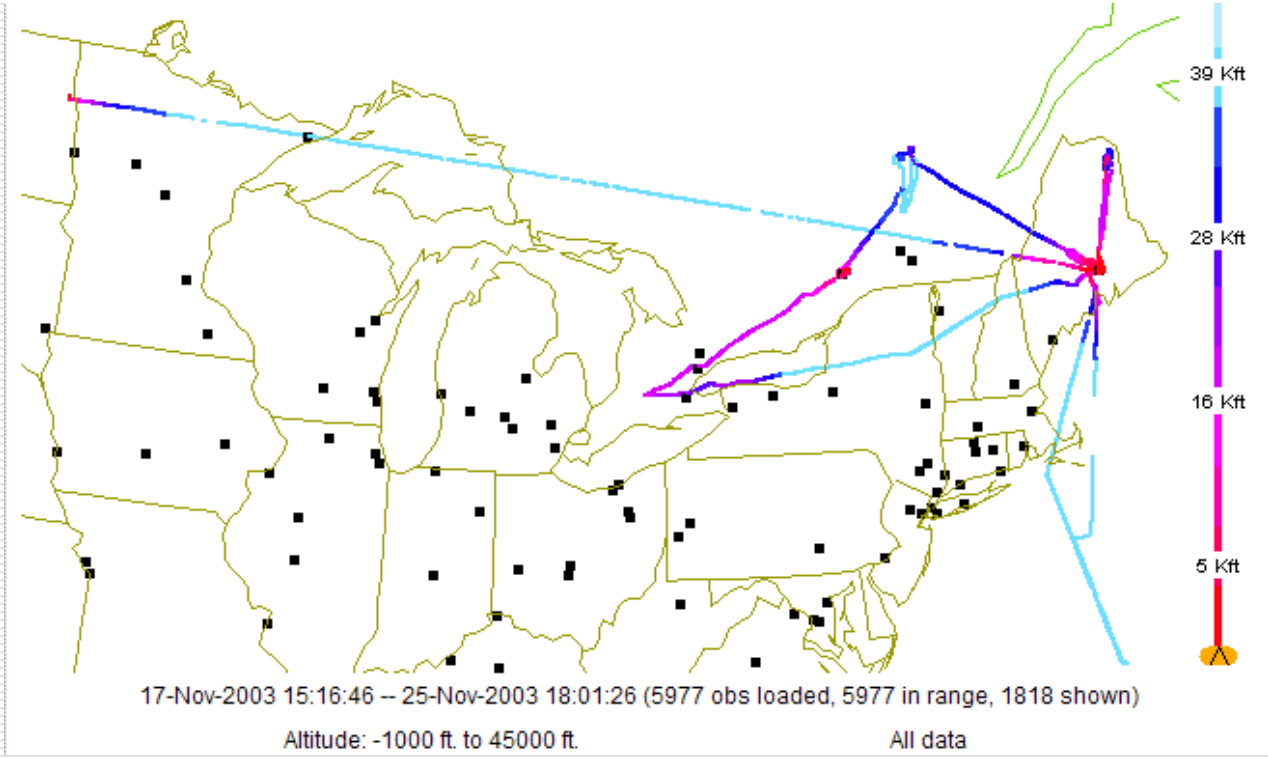
Carrier participation benefits

AIRDAT

Enhanced operational information

- OOOI times, departure and arrival airports
- GPS tracking
- Text messaging
- Airborne trouble ticketing
- Other systems monitoring

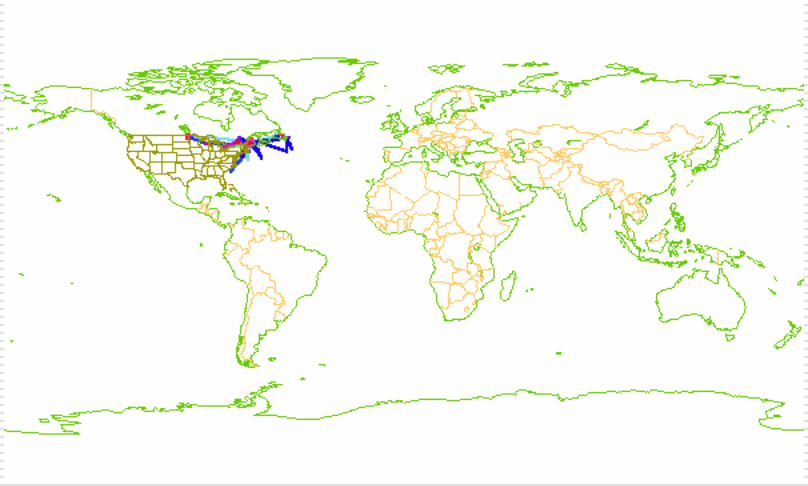
Real-time aircraft tracking

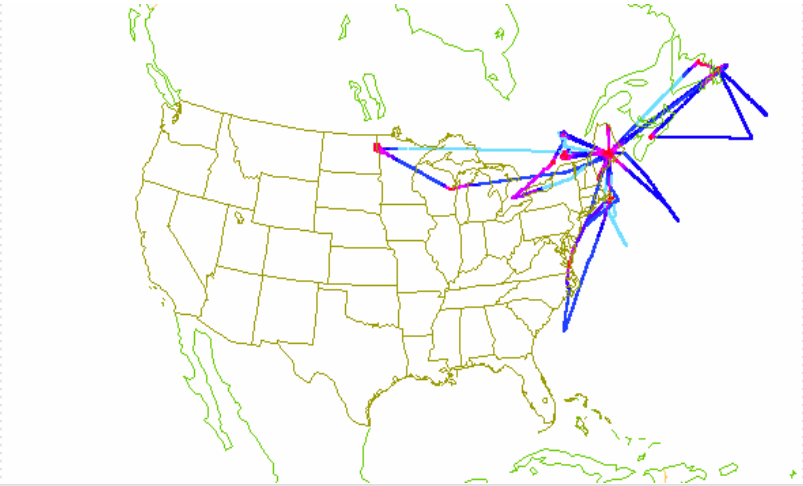


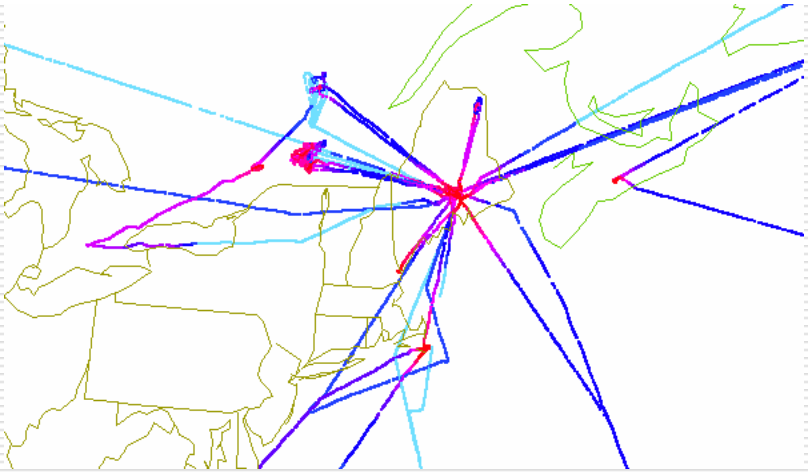
The TAMDAR system enables real-time global tracking of all equipped aircraft

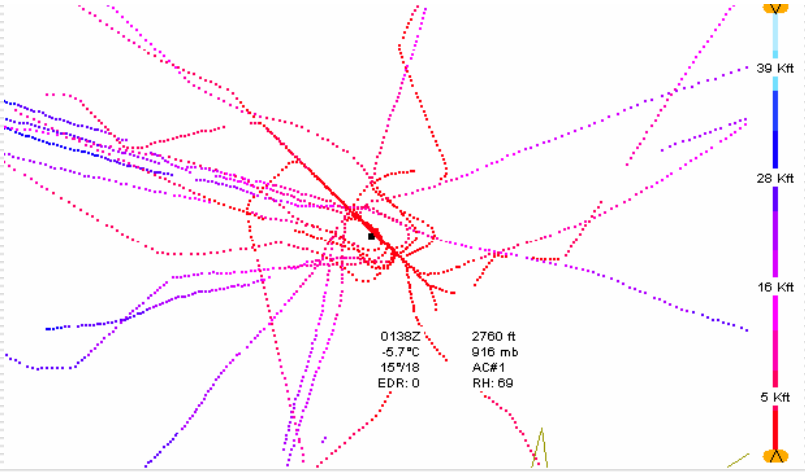
Real-time aircraft tracking

AIRDAT









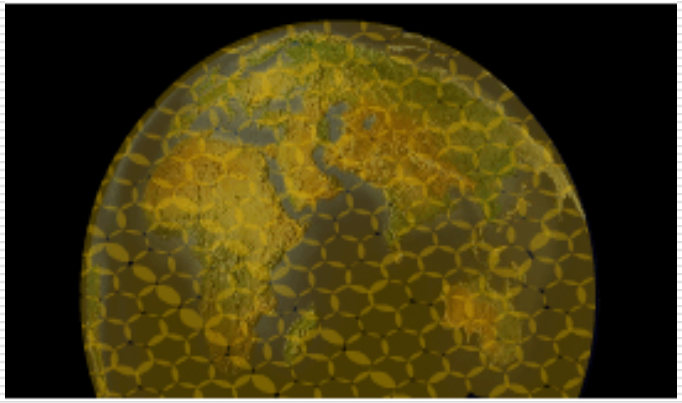
Datalink criteria

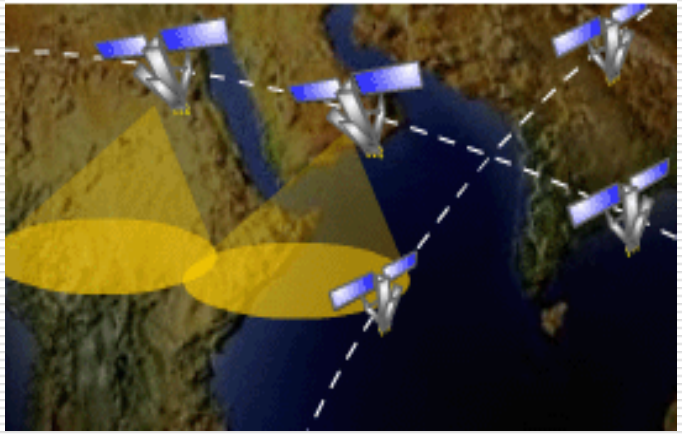
AIRDAT

- Available now
- Financial stability / reliability
- Two-way capability
  - Observation downlinks
  - Control uplinks
- Minimal latency
- Global coverage at all altitudes to ground
- Affordability
- Additional capabilities

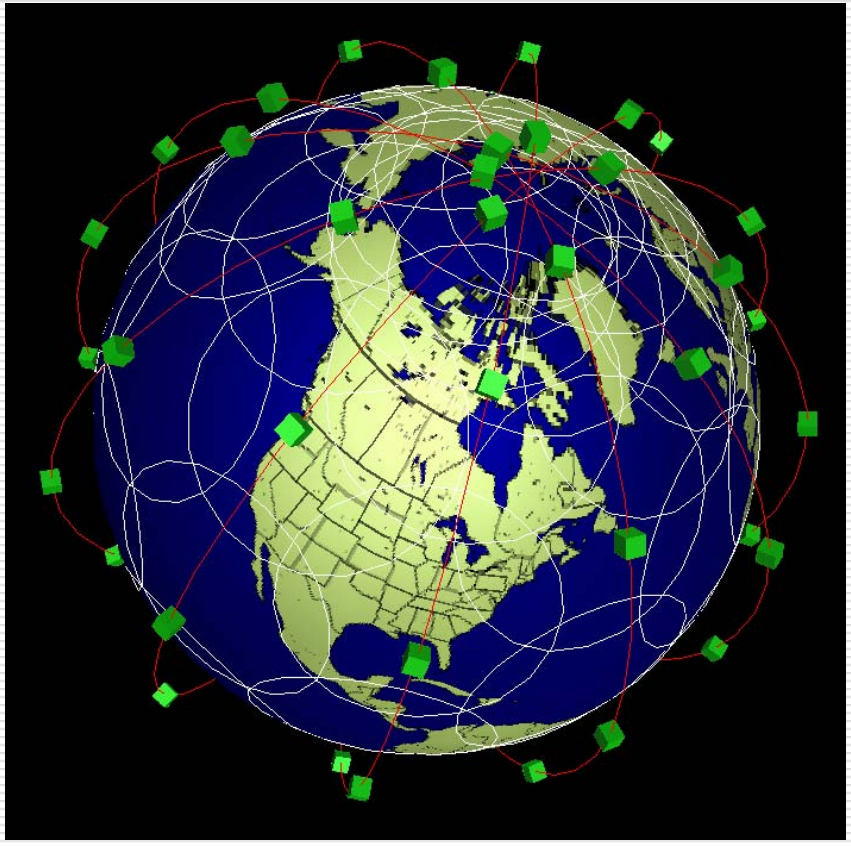
Aircraft datalink capabilities

- Iridium Satellite selected (AirDat is a VAR)
- 66 four-way cross-linked LEO satellites provide complete global coverage and minimal latency
- Satellites relay messages and need not be in same footprint as the gateway





Aircraft datalink capabilities



The AirDat/Iridium network provides an autonomous global communication channel to/from each aircraft.

TAMDAR does not interfere or compete with existing flight-critical communication systems.

AirDat Facilities

To support TAMDAR, AirDat has established:

- A business office and data center in Raleigh-Durham, NC
- An office/R&D facility in Evergreen, CO

Facilities

Operations Center (NC)

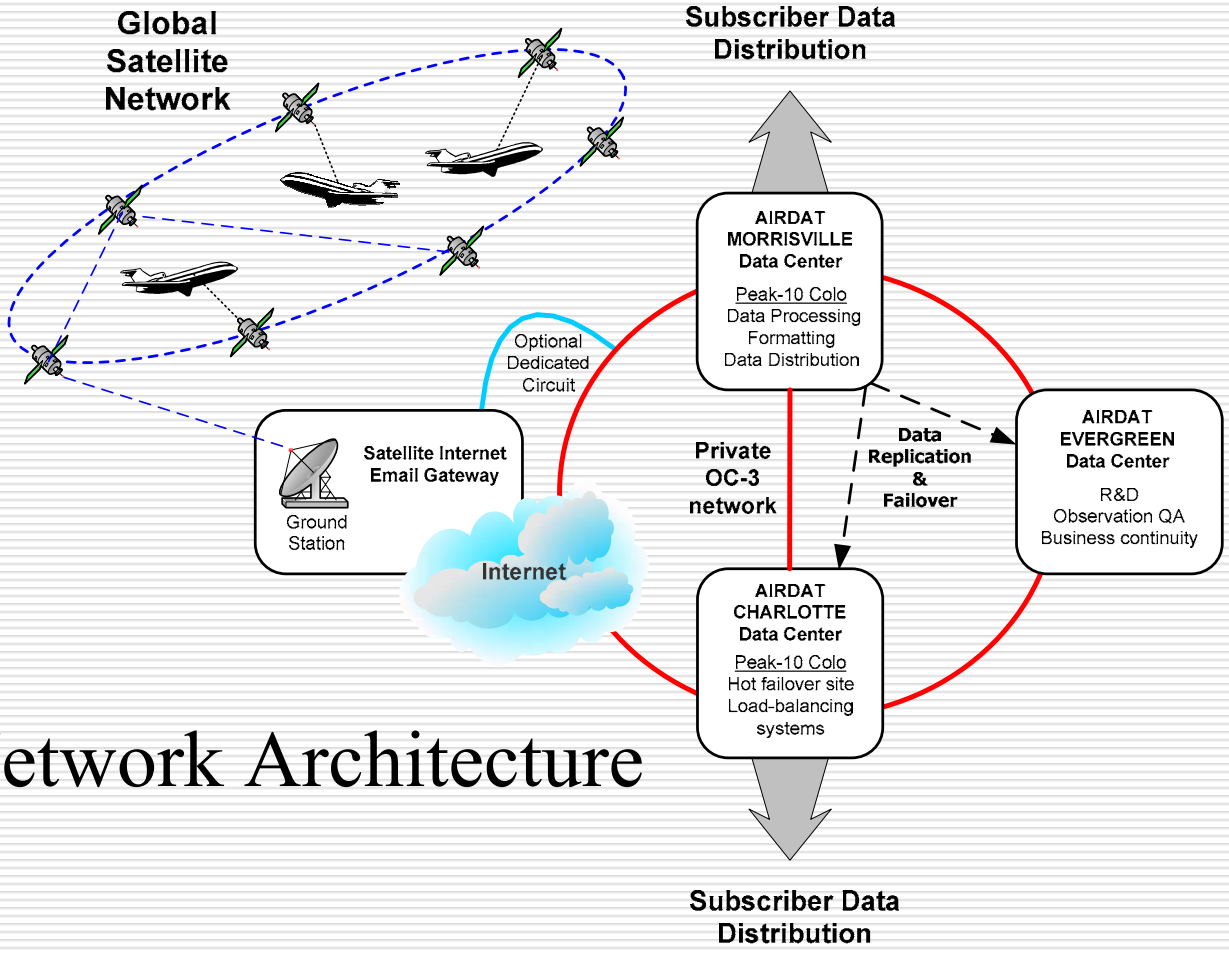
- Business office
- Network operations mgmt.
- Data receiving, archiving, processing and distribution
- TAMDAR lifecycle mgmt.
- Data center in same building
- Located in technology park 5 min. from RDU airport

Facilities

Research / Development (CO)

- Engineering & testing
- Certification management
- Manufacturing management
- Observation data QA
- Fully equipped electronics lab
- Wind tunnel
- 20 mi. from Denver & Boulder

Facilities



AirDat Network Architecture

Ongoing partnership with NASA

- Many areas for cooperation in the future
- Continued opportunities to develop TAMDAR products
  - Achieve NASA AWIN & WINCOMM safety goals
  - Development of TAMDAR based aviation hazardous condition displays
  - Integration of TAMDAR data into forecasts for enhanced aviation weather
  - Integration of TAMDAR data into cockpit displays
- Utilization of TAMDAR/AirDat infrastructure to improve aviation safety and services

Aviation weather products